An all optical system for studying temperature induced changes in diamond

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It is acknowledged that temperature induces damage in the diamond bits due to friction during the drilling process.
We can raise the temperature of the diamond sample by laser heating it.
Laser heating of diamond by optical absorption

- CO₂ laser
- ZnSe Beam Combiner
- R = ∞, Cu Mirror
- Au Coated Mirror
- ZnSe Beam splitter, Reflection 84%
- ZnSe lens, f = 250 mm
- Sample
- Diffractive optic element
- HeNe laser
- R = ∞, Moly Mirror
- R = ∞, Au Coated Mirror
- Infrared camera
- Diffraction optic element
- HeNe laser
- R = 6 m, Moly Mirror
- ZnSe Beam splitter, Reflection 84%

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We can engineer two boundary conditions in our experiment:

- Insulator
- Water-cooled
In insulator case, we expect the peak temperature on the sample to increase as the laser power increases.
We expect a rapid rise in temperature until steady state

Model prediction

Experimental data
At steady state we predict a uniform temperature profile across the sample.
In water-cooled case, we expect the temperature on the sample to increase as the laser power increases.
We expect a rapid rise in temperature until steady state.
At steady state we predict a gradient temperature profile across the sample.

Model prediction

Experimental data

- Model prediction graph showing temperature as a function of distance from the center.
- Experimental data graph with different power levels indicating temperature in Kelvin and pixels.
Summary
Conclude remarks
Thank You